

Kingsley (N. W.)

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INTO THE
CAUSES OF IRREGULARITIES
IN THE
DEVELOPMENT OF THE TEETH.

A PAPER READ BEFORE THE NEW YORK ODONTOLOGICAL
SOCIETY, DECEMBER 16TH, 1874.

BY

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OF DENTAL SCIENCE, AND OF THE ODONTOGRAPHIC SOCIETY OF PENNSYLVANIA, ETC.

AND THE DISCUSSIONS WHICH FOLLOWED.

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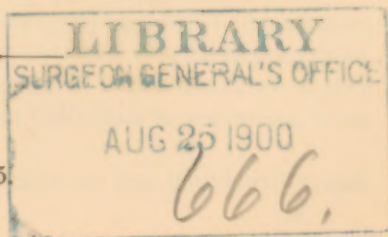
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THE CAUSES OF IRREGULARITIES

IN THE

DEVELOPMENT OF THE TEETH.

THE subject of "The Treatment of Irregularities in the Development of the Teeth" is forcing itself upon the attention of the dentist with an alarming frequency. In no branch of practice does scientific knowledge seem to be sought with more avidity than in this direction. The tediousness of many of these cases; the inventive skill required to make successful appliances; the doubt always hanging over the final result; the lack of appreciation often of the highest order of professional skill; the absence of a prospective remunerative fee, as a stimulant; together with a want of knowledge of the causes operating to produce such an untoward result, combine to make these cases the "*bête noir*" of dental surgery.

As the highest order of scientific investigation is now directed more to the prevention of disease than to its remedy, no more important subject can now engage our attention, than an inquiry into the origin of these deformities, and of some means to be used to prevent their recurrence in our offspring. And here, upon the very threshold of our research, we are confronted with the paucity of our knowledge, and the feebleness of our abilities; for science never has and never can discover the primary cause of any one of the phenomena of nature. With all her efforts, she has succeeded in penetrating only a little further into the unknown, leaving the origin still as dark and mysterious as ever. Nevertheless, there are operations in nature which, for the purpose of science, may be denominated primary causes, which may be discovered, measurably controlled, and their disastrous influences averted.

Many of the forms of irregularity are directly traceable to inheritance, and are transmitted peculiarities. Probably in a very large proportion of cases where the irregularity in a dental arch is confined to one or two teeth, the primary cause, so far as that individual is concerned, is an hereditary family peculiarity.

The teeth of every person possess more or less individuality, and

most of those peculiarities which stamp their individuality are inherited. The form and color of teeth, when not disturbed by abnormal influences, are derived from the same source.

Whenever we find any departure from what we are apt to regard as the typical form of each tooth, or any disproportion of size in their relations to each other, we shall be likely to find them peculiarities of descent.

The transmission by inheritance of a predisposition to a defect or a deformity, is the result of the same general law of nature which gives the form and features of progenitors to their offspring.

In the light in which we are now discussing this subject, it would be unprofitable to attempt to discover the cause of the minor peculiarities in dental development, which have clearly an origin in the ancestry of the individual. An investigation of this character would involve the discussion again of the "Origin of Species," and we should be compelled to admit,—as we have heretofore and must always hereafter,—that there lies a cause beyond all that we can comprehend, and which never can be reached by finite minds

It is certainly a most wonderful subject for contemplation that, at some remote period in the history of our progenitors, nature departed from her normal type, and a dwarfed lateral incisor, a twisted canine, or an undeveloped bicuspid was the result; and following down the line of descent, we find precisely the same peculiarity appearing and reappearing; not always confined to the direct line, but continuing in the same family, by passing to the children of the brother or sister, and always presenting characteristics identical with the antecedent type.

"There is an ingrafted tendency in all living organized matter to reproduce itself."

It is yet to be determined whether the correction of the irregularities of the dental organs exercise any influence upon the offspring. That the correction of a congenital deformity in a parent will prevent its transmission, is no more to be supposed than would be the expectation that if we removed all the eyes from the present generation, the next would be born blind, excepting in so far that we have a right to expect that, in a transmitted deformity, nature will be making a constant effort to return to the normal type, while a created deformity would be by nature ignored.

Irregularities, either in the form of the arch or the position of the teeth, are very uncommon in the deciduous set. I have never seen an irregular arch in a child prior to the eruption of the permanent teeth, unless associated with and correlated to some other deformity. I have in a few instances seen a slight malposition of one or more of the incisors, sometimes of congenital origin, and sometimes the result of mischievous habits; as, for example, the two centrals may be pulled forward out of line by the prolonged use of an artificial nipple, sucking the

thumb, or other similar habit. Of congenital deformities, it is rarely more than a trifling displacement of one or two of the incisors; but considering the temporary character of the deciduous teeth, and more especially the incisors, no irregularity in their position, that I have ever seen, can be regarded as having any material bearing upon the greater subject now under discussion.

They are to be classed as mere freaks of nature, not associated with nor indicating any other peculiarity in the child. Nor does it by any means prognosticate an irregularity in the development of the second set. This important fact cannot be too prominently borne in mind. The deciduous dental arch is always well formed, and the positions of the teeth are regular (mere freaks of nature excepted). And from this perfectly symmetrical dental arch there develops with the growth of the permanent set some of the most astounding abnormalities.

These peculiarities of the permanent teeth it is unnecessary to describe in detail. In the departure from symmetry they assume almost every variety of position, so that it would be almost impossible for the human mind to conceive of an irregular arrangement which would not find its counterpart in nature.

These variations are recognizable by every one of extended observation, and are deformities, because they are a greater or less departure from a normal standard. Such a standard cannot, in the very nature of things, be one shape to which all must conform or be classed as deformed.

Symmetry and harmony do not imply uniformity; and the dental arch may be developed up to the highest type of perfection, and yet there exist as great a variety of form as there would be in the faces of the aggregated beauties of the world.

Races, nations, and families are thus represented without deformity.

The normal type of the dental arch I conceive to be a regular line; the arch may be wider or narrower, varying somewhat in individuals or races, but the line would be an easy, graceful curve, without break or tendency to form an angle.

Within certain limits a narrow dental arch, as associated with certain features, may become the very perfection of beauty, while with another form of head and face the widest development may be equally pleasing. That which is recognized now as the standard or full measure of beauty, as well as of utility, is not unlike that which existed in the remotest historic ages, nor different from that which is now exhibited among all communities not degenerated by luxury or vice.

I have recently held a most interesting conversation with Dr. Nichols, who has spent twelve years in the Rocky Mountains and on the Pacific Coast, during which period he has examined the mouths of thousands of Indians and Chinese. He informs me that he never saw an instance

of irregularity of the teeth in either of those races, with but one exception, and that a displaced canine in the mouth of a Chinese woman. The jaws of both races are universally well formed and amply developed. This is the evidence of an expert,—Dr. Nichols being a practitioner of dentistry. And this is also true of all semi-barbarous and savage races of good physical organization.

In 1864, Messrs. Cartwright and Coleman, of London, made an examination of some two hundred ancient skulls in the crypt of Hythe Church, Kent. These skulls, of which there is no authentic history further than that they have been there for centuries, were apparently of both sexes and all ages.

The maxillæ presented in all instances unusually well-developed alveolar arches. The teeth were remarkable for regularity of position, only two deviations being noticed; one upper canine shut within the lower jaw on occlusion, and one bicuspid was turned upon its axis, and there might have been other slight irregularities which were unnoticed; but in no single instance was there anything seen approaching to that which, under the term "contracted arch," so commonly exists in the present day.

The average width of the dental arch in these skulls from the outside of the first molar to the corresponding point was two and a half inches.

In 1869, Mr. John R. Mummery, of London, contributed to the Odontological Society of Great Britain the most valuable paper on this subject which I have ever read. I accord more importance to his personal examinations than I do to the observations of any man not a practical dentist. The statements of all others, even those of ethnologists, being less precise and more general in their character, must be accepted with some allowance. He examined all the available skulls of ancient races, and of modern uncivilized races, to the number of about three thousand, and tabulated more than one-half of them, which were classified as follows:

Ancient British, 203; Roman British, 143; Anglo-Saxon, 76; and Ancient Egyptian, 36.

Of modern uncivilized races: North American, 145; Polynesian, 204; East Indian, 223; African, 438; and Australian, 165.

From a careful analysis of the measurements given in his tables, I find that the average width of the dental arch from first molar across to first molar, in the skulls of ancient races, was a trifle less than two and three-eighths inches; the same measurement of the uncivilized moderns showed an average width of a trifle above two and a half inches.

The narrowest measurement given by him of any skull of any race is two and one-eighth inches.

The highest average of any race is nearly two and three-quarter inches, and these belong to the New Zealander, the Fejee Islander, and the Ashantees.

The narrowest average was found among the Hottentots and Bushmen of South Africa.

In these tables we have abundant evidence that the full measure and type of both dental and maxillary arches has been sustained among all peoples of simple habits and thoughts in all ages.

The standard of normality of the dental arch is a curved line expanding as it approaches the ends, and the teeth all standing on that line.

Abnormality will include such a shape of the arch as is not in harmony with the surrounding features; all crowding and twisting; and all departures from a regular line in the positions of the teeth.

Almost the only answer received by the dental student as to the cause of these irregularities has been "premature extraction of the deciduous teeth," and consequent contraction of the jaw; and this answer has been almost universally accepted without a question as to its philosophy. A few facts have been correlated, and a conclusion as unscientific as it is erroneous arrived at; and to the anxious inquiry of the parent has come the charge made against some other dentist of gross malpractice.

It is only within a few years that any one has been bold enough to doubt the universally accepted theory which so glibly accounted for every presentation of abnormality. Among those who have pronounced this ground as untenable, and publicly given their arguments, may be mentioned Messrs. Cartwright and Tomes, of London, and Dr. Forbes, of St. Louis.

Their arguments are based upon the deductions of science and the observation of facts, and are also confirmed in the experience of others.

The premature-extraction theory rests upon the supposition that the jaw-bone contracts upon the removal of the deciduous teeth. The fact seems to have been entirely ignored that the teeth and alveolar processes are a superstructure of the jaw-bone; growing upon it; fulfilling their destiny, and passing away without disturbing the foundation much more than an oak disturbs the planet upon which it has been sustained.

There exists a period in the history of the maxilla when it is itself an entity, and prior to hardly a trace of the subsequent superincumbent structures; and in the ordinary course of nature there comes a period at the other end of life when equally all trace of dentition is gone and the maxillæ remain an undestroyed entity.

While the proofs are conclusive that the jaws are developed independently of the teeth and alveolar processes, and that no ordinary surgical interference with the teeth or processes impedes or impairs

that development, and while it may also be true that all the primary teeth may be removed long anterior to the period of eruption of the permanent ones without retarding their development or impairing their regularity, the doctrine may still be correct that the too early extraction of some of the temporary teeth will be likely to result in a crowded and abnormal condition. This result is not as likely to show itself with any other teeth as with the canines.

Let us look carefully into the order of the eruption of the permanent set in the regular economy of nature. It will be admitted that for every individual tooth of the deciduous set there is a permanent one lying underneath it in process of formation, and that in due time a deciduous tooth will loosen and fall out, and a permanent one will take its place.

In a normal state there will occur no interference and no irregularity. The central incisors will first appear; then the laterals; after that the bicuspid; and lastly the canines. Each predecessor of a permanent tooth will maintain its position until about the period of the emergence of its successor. There would be no contraction of the alveoli, because there would be no opportunity for it.

But taking now a disturbed, instead of a normal condition, let us see the result.

Remove for any cause one after another, or all at once, of the temporary set, and the period of development would not be interfered with, but the arrangement in the arch might be impaired.

The centrals would find a place without difficulty,—so would the laterals; the bicuspid would be pretty certain to have sufficient room, as their diameters are generally less than their predecessors; but when these teeth were all fully erupted, it would be found in a majority of cases at the present day that the first bicuspid and the lateral were nearly or quite in contact, filling the space destined for the permanent canine, which must now emerge either anteriorly or posteriorly to its true position, showing conclusively that if the alveolar arch had not contracted, the contiguous teeth had encroached upon the space destined for the canine, and forced it out of position. In either case it was the unquestioned result of the too early removal of the deciduous canines, for no one will doubt that, had the temporary canines been allowed to remain, they would have prevented contraction of the alveolus or an encroachment on their domain. It may be argued that if the original direction of the canine was correct, it would force itself between the lateral and bicuspid, thus making way for itself; but this is against the experience of nearly all observation, and very naturally so.

Admit the fact that from some cause or other the bicuspid and lateral come into contiguity, and from the tardiness of the erupting canine, it will find solid and unyielding roots to contend with, which will necessarily force it out of the dental arch.

Mr. Tomes relates a case in which he removed, for cause, from a child, all of the deciduous teeth prior to the eruption of any of their successors, so that for a time the gums were edentulous; nevertheless, in due time the permanent teeth developed in perfect regularity of sequence and of symmetry.

While Mr. Tomes's report shows that no abnormality followed the removal of all the teeth at once, such a result is to be feared from such a practice, and most certainly will ensue if there be not a coincident independent, and ample development of the maxillæ. Cases are coming constantly under our observation where from some cause the temporary canines have been sacrificed, the space closed up, and the permanent teeth malposed, with little hope of their ever assuming, unaided, their rightful positions.

From this there can be but one deduction,—which is, that whatever may be the inducement to remove any or all of the deciduous teeth prior to their period of shedding, the canines should be retained until there is ample evidence of the early emergence of their permanent successors.

How much of the malposition of the permanent teeth is due to the prolonged presence of the temporaries, is, I think, still an unsettled point.

Although absorption may be proved to be an independent process, and in no wise connected always with the progress of an erupting tooth, nevertheless, the cases are so common in which the absorbed portion of the deciduous tooth corresponds so accurately with the new crown, as to force upon us the conviction that it is influenced by it, and therefore that if the permanent tooth had persisted in the right direction the deciduous tooth would have become displaced.

The question very naturally arises, Is the presence of the deciduous teeth the *cause* or the *effect* of the irregularity? If their presence be the cause of irregularities, then it is manifest that in this generation of malposed teeth it is our duty to anticipate the trouble, and at an early day remove them, before even it is possible for them to give a wrong direction to their successors. Whether their presence be the cause or the result of the malposition, this we do know, that when a permanent tooth has erupted, and its deciduous predecessor has not been removed, the immediate extraction of such tooth will go very far toward the complete correction of the deformity.

I do not see in this very common fact any greater evidence that the presence of the temporary tooth caused the irregularity than that the position and tendency of the permanent tooth was originally wrong. It is quite as reasonable to adopt the latter view as to suppose that the function of absorption was arrested, and by that the tooth was turned aside.

In seeking information of the causes of irregularity more with a view of discovering some means of prevention than of correction, it was with some disappointment that I read Mr. Tomes's explanation of certain abnormalities which he had observed, described, and treated.

For example, in describing cases which are not uncommon where the upper front teeth project unduly, shutting over the lower lip, he says,—

"The deformity may result from excessive development of the alveolar processes of the anterior part of the upper jaw, but more commonly we shall find that the molar teeth are unusually short, thereby allowing the incisor teeth of the lower to press unduly upon the inclined lingual surfaces of the teeth of the upper jaw. The upper teeth, yielding to the pressure, are forced outward, and are retained in the malposition by the teeth which have led to the displacement. If, in cases resulting from the latter cause, the inquiry be extended to the condition of the lower jaw, it will be found that with the short molar teeth we have a short alveolar range and short rectangular ramus. This conformation is probably the primary cause of the mischief."

Again he says,—

"The condition under consideration may also arise from the tardy eruption of the molar teeth leaving the incisors to act for a time upon each other, as they do when from any cause the back teeth are lost. Then again, the incisors of the lower jaw may attain an unusual height, or they may project in an unusual degree, and produce the mischief. Or the result may be consequent upon a regular linear arrangement of large teeth in a jaw having a small alveolar base, in which case the teeth prior to their eruption will assume an unusual anterior obliquity."

But may we not very pertinently ask, What was the cause of the "excessive development," the "short molar teeth," the "short alveolar range," or the "short rectangular ramus?" The explanation can be regarded in no other light than a description of antecedent phenomena, but the origin of the deformity has not been reached.

In a paper read before the Odontological Society in London in 1864, Mr. Cartwright says,—

"Want of space in the bones of the jaws may be defined as the true cause of irregularity in the position of the teeth in the majority of instances;" and follows this statement immediately with an inquiry as "to a satisfactory explanation of this want of capacity in the jaws of people of certain communities."

He further says,—

"Irregularity is uncommon among many, if not most, aboriginal peoples and tribes, and also the inhabitants of particular districts and locations. Take the aborigines generally, North American Indians, Africans, Caffres included, and Asiatics.

"Irregularity is common in most highly civilized communities, and

especially so among the upper and middle classes, and it is more constant among the inhabitants of towns than it is among the inhabitants of agricultural districts."

Mr. Cartwright then offers the hypothesis that this abnormality is due to a process of breeding, and brings forward Mr. Darwin's statements that the bones and plumage of birds become altered by such a process.

He further supports his position by the results of high breeding among animals, which is maintained by constant and careful selection of such as possess particular points and characteristics.

For instance, he says, "Take the horse and the ox, and consider the points which make up a thoroughbred animal, the small head and ears, the thin legs, small fetlocks and feet, the necks and bodies finely and symmetrically proportioned, and then the narrowness and comparative smallness of the maxillæ. From the results obtained by high breeding in animals, they might reasonably argue that small jaws might be a characteristic of breed in certain conditions of life. If they compared two types of human beings, represented by the upper class in one case, and in the other case by a large class of which the prize-fighter furnished an apt example, they would find as a rule in the first; well-shaped lips, a small oral orifice, high and capacious forehead, well pronounced chin, ears small, and neck long; the ankles, wrists, feet, and hands small; with an expression in which the intellectual predominated over the animal;" while the other class, represented by the prize-fighter, presented exactly the opposite characteristics.

The hypothesis of Mr. Cartwright is not without reason;* and yet it is not altogether an explanation of the present phenomena, for the laws which govern selective breeding in animals do not apply to man in any condition in which he is now found. These principles would, without doubt, produce precisely similar results if applied under similar conditions.

Regard man as an animal only; dismiss all cognizance of his intellect and his affections; mate him to the woman with sole reference to the physical development of the race, and it would take but a few generations to see disease and deformity swept from the face of the earth. But to call the intermarriage of families, whose brains have been stimulated to their highest capacity and whose physical and nervous systems have been deranged by the habits of modern civilization,—to call such a mixture high, or "selective breeding," is a perversion of the

* It is more than probable that Mr. Cartwright uses the term "*selective*" here in its broadest signification; meaning the mixing of peculiarities or types which have a tendency to depart from normality, and not in its more restricted and limited sense of combining only excellencies, as the term when applied to breeding is commonly understood.

term. If the application of these principles produces a delicacy of form in the whole physique, we should reasonably expect to find a corresponding delicacy and refinement in the condition of the dental organs.

That the process of selective breeding should tend to, or end in, deformity, is manifestly inconsistent with its prime object, which is the elimination of everything which tends to degeneracy or deformity.

The characteristics pointed out by Mr. Cartwright in his illustrations from animals are conspicuously æsthetic.

We can conceive of no such force acting uniformly upon the whole physique, and producing such æsthetic results without its influencing equally the dental organs, and thus there would be not only no irregularity or abnormality, but enhanced beauty,—more symmetrically formed, more symmetrically arranged, and more symmetrically related dental organs. We are therefore irresistibly led to the rejection of the theory of “high or selective breeding,” in its true signification, as exerting any direct influence upon the malposition of the permanent teeth, and while the facts noticed by Mr. Cartwright are in consonance with other observers, we are forced to the conclusion that such abnormalities are not a necessary result of a higher civilization and refinement, and that they are only coincident and correlated thereto.

There is a kind of breeding which does undoubtedly produce abnormalities of the kind under discussion. It is a manifestation not uncommon in this country of mixed nationalities, but it can hardly be called *high* or *selective* breeding. The laws of inheritance, confirmed by common observation, show how constant is the mingling in the offspring of the traits of character and the peculiar features of two diverse races brought together in marriage.

This mixing, without blending or harmonizing, is productive of deformity in character and deformity in physique. Thus, so far as the jaws and teeth are concerned, they may exist in each parent in perfect symmetry,—in one parent the jaws and teeth are large, in the other parent both jaws and teeth are small; but each in its way is a normal development. If, now (and for which we can give no reason), the small jaw of one parent and the large teeth of the other appear in the offspring, deformity is sure to follow; and in any efforts made thereafter towards correction, these facts must be taken into consideration.

In examining the maxillæ of a child between the ages of four and seven years, with the external walls removed, so as to expose the developing permanent teeth, we shall be struck with the advanced stage of growth which the crowns have attained, and with the crowded and jumbled condition in which they are placed. Of such an exhibition Professor McQuillen made the following remark:

“When examining a series of jaws of different ages, arranged so as to show deciduous and permanent teeth, it is not a matter of surprise

that there should be irregularity in the permanent set; but, when observing their crowded and irregular arrangement in the jaw prior to eruption, it is rather a matter of astonishment that they should ever assume a regular and symmetrical appearance."

In *our* investigation we will observe that while there is no transposition of these crowns—each one maintaining its individual locality—they nevertheless stand in almost every variety of position. They will be seen deflected within or without the line, twisted, lapping, and sometimes completely overriding one another.

FIG. 1.



In the specimen now before us (see Fig. 1), the lower permanent central incisors have recently erupted, showing the age to be about seven years. Their predecessors are the only ones of the deciduous set which have been removed. The general contiguity of the temporary teeth shows that but little enlargement of the dental arch had taken place, while the presence of the crowns of all the permanent teeth (the third molars excepted) is an ample illustration of the crowded confusion and disorder which has been described. In the upper jaw the left central incisor is partially twisted; both of the lateral incisors are within the arch, and, if continued on the same line, would shut within the lower jaw.

The crowns of the canines override and are in front of the laterals, and in contact with the central incisors save by a thin partition of process.

The first bicuspid on each side are in close contiguity with the laterals. The crowns of all the bicuspid are either twisted or tipped in such a way as to show that some new direction must be given to nearly every tooth, or irregularity of the most pronounced character must ensue.

The general condition of the lower teeth is not dissimilar to the upper ones, and this example is not an exceptional case.

These crowns, we shall also observe, are of their full diameter, and that they are placed upon a maxilla which at this age has not developed sufficiently to allow them to range side by side upon a true dental line; hence, they must remain in this crowded and irregular condition until the maxilla itself has grown large enough to allow the change.

It is now an established fact that the development of the teeth and processes and the development of the jaws are two distinct and independent operations.

The maxillæ will go on in their growth until they have reached the measure prescribed by the Creator, whether a tooth develops or not, and likewise the teeth will grow into undiminished crowns and erupt either in order or disorder, whether the maxillæ increase or remain stunted.

I examined a few years since the mouth of the celebrated dwarf, "Tom Thumb." I found the teeth those of a man in individual size; but the maxillæ, in harmony with the rest of his osseous system, were dwarfed. The result was what we should naturally expect,—a most marked malposition of the teeth,—so much so that he said he "had a double row of teeth all around." And this is uniformly the case with dwarfs where the whole physique is symmetrically dwarfed. The converse is also true of giants, except in those cases where the extraordinary stature is a characteristic of race.

To such an extent are these observations in accordance with both science and fact, that it is quite possible to judge of the nature of both these monstrosities, whether they be congenital, hereditary, or *lusus nature*. If, upon the examination of the fully-developed teeth of a giant, I found them large, regular, and in a well-formed arch, the whole in harmonious relation to his other enlarged features, I should have little hesitation in pronouncing him a congenital giant,—a large man by nature, and belonging to a family or race of giants. If, on the other hand, I found the teeth the size of those of a man of ordinary stature, and standing apart from each other in an enlarged jaw, I should pronounce him the result of forces which did not antedate his own existence, but continued their power long after the development of the teeth

after their hereditary pattern had been completed. And in like manner a dwarf belonging to a race of small stature would not necessarily show irregularity or crowding of the teeth, but would be expected to show a reduction in size of the dental organs in consonance and in harmony with the type of his race.

This is but a confirmation of the theory of the independence of these organizations; the evidence from a variety of sources going to show that the forces which preside over the growth of the osseous system are separate and distinct from those which originate and develop the dental organs, and that while in a normal state both teeth and jaws would grow in harmony, in an abnormal condition the teeth might be far in advance of the growth of the jaws, or they might be equally retarded.

If the former, they must erupt in a crowded condition; if the latter, they would, other things being equal, be likely to be in line.

In recognizing an antagonism, I cannot but be impressed with a similar contest going on, more or less frequently, between the mental and the physical development,—between the brain and the body. In the normal state of man these two systems are found working in harmony; in the present refined or degenerate state, each is fighting for supremacy, with the odds in favor of the brain.

No one of extended observation will hesitate in believing that there is a faculty or power at work, modifying materially the physique of the present generation, altogether inexplicable by the too commonly asserted influencing power of climate, hygiene, or diet. One of the most alarming characteristics of the present age and the present civilization is found in the rapidity of its movements and the activity of its mind; in the larger aggregate of highly-organized and excessively developed nervous systems, and in the increasing tendency to nervous and brain diseases.

As the peculiarities of progenitors in mind, temperament, and physique, are by nature stamped upon their offspring, we see a generation of children inheriting a tendency to a nervous exaltation which very slight favoring circumstances encourages and stimulates. This is unquestionably more noticeable in the centers of luxury in this country than in any other portion of the civilized globe. Fathers who are under a mental strain to the very verge of insanity transmit that exaltation to their offspring. Children are no longer children, except in their immature physical development; and thus, if not in all instances an absolute intellectual precocity, we have relatively a mental and nervous development far in advance of the physical. Hence, if the mental is only up to the average of its years, we will find it associated with anything but a robust physique; and the contrast remains the same. I shall show that one of the manifestations of this precocious,

highly-organized, and exquisitely-developed nervous system is its influence upon the development of the teeth, while the physical system is following in tardy but vain efforts to keep pace with it.

My proposition then is this: laying aside all cases that may be due to an inherited tendency to follow or exaggerate some given type, together with those which are manifestly due to forces operating only after eruption; the primary cause, so far as the individual is concerned, of any general disturbance in the development of the permanent teeth, showing itself particularly in their malposition, is directly traceable to a lesion or innervation of the trigeminal nerve; that it is an interference, more or less prolonged, with one of the prominent functions of that nerve, and operating at its origin; that while I know of no way to prove this assumption by any examination, microscopical or otherwise, while the nerve-center is under this influence, it is nevertheless sufficiently proven by secondary phenomena which could only have originated from such a source.

The function of the trigeminus thus stimulated or interrupted is that which supports, regulates, and governs the nutrition of the tissues to which its terminal branches are distributed.

That such a lesion or innervation would be likely to produce such a result, is clearly foreshadowed in the following statement made by the late Professor Anstie in one of his lectures on the fifth nerve, as follows:

"The nervous center in which the trigeminus is implanted is, of all nervous centers, the one which, in the human subject, is most liable to congenital imperfection of the kind which necessitates a break-down in its governing functions at special crises in the development of the organism."

I do not find in any of my reading that any author on the causes of malposition of the teeth has made this direct connection between the abnormality and disturbance of the nerve center during the formative and eruptive period; but I do find a large array of facts, confirmed by my own observations, which point in my own mind to this only conclusion, and although other observers of similar facts have attempted in many instances an explanation of what they saw, they have failed to refer them to any satisfactory *primary* cause.

In Mr. Mummery's paper, before referred to, in speaking of *diseases* of the teeth, he says, "It is to be feared that a large amount of dental disease is originated by overtaxing the active brain of children. According to the best authorities, the most rapid increase in the growth of the brain takes place before seven years of age; and it must be remembered that the crowns of all the permanent teeth, with the exception of the third molars, are simultaneously in the course of development with this great advance in the size of the brain. May we not, therefore, reasonably

suppose that through the diminished vitality consequent upon this diversion of the formative energy from the teeth, by premature mental exertion, these organs necessarily become degenerated, and that this circumstance constitutes one great difference between the teeth of the intellectual and those of the uncultivated families of mankind?"

Dr. Nathan Allen, in his remarkable discourse delivered before the Massachusetts Medical Society, commenting upon the change going on in the human organism of the present day, says,—

"This change indicates the existence of less muscle, more nerve; less physical vitality, more nervous energy; less power of endurance, but more mental activity.

"This same change is also indicated in the anatomy and physiology of the person. The framework of the body generally is not so large, is not so compact, nor so well proportioned; the countenance is paler, the features are more pointed and not so expressive of health, though more so of intelligence. The texture or quality of organization is more delicate and refined; the brain is becoming developed more and more relatively, and too frequently at the expense of the body; or, in other words, the nervous temperament, with all its advantages and disadvantages, is becoming too predominant for other parts of the body. As one of the consequences we have more diseases of the brain and nervous system, more sudden deaths from apoplexy, paralysis, and also from diseases of the heart. . . .

"The removal of so large a proportion of the population from the country and rural life to cities and large towns; the change of employment from farm-work,—from out door exercise and the more laborious mechanical pursuits,—to lighter kinds of business, with increased exercise of the brain; add to this the greatly increased strife, excitement, and competition in every department of business and society,—all these changes must serve gradually to diminish muscular power and the general vitality of the system. No truth in vital statistics is better established than the fact that large cities and a dense population tend to diminish the physical energies of the body and shorten human life. . . .

"The simple reason is, as we conceive, that their style of living taxes the brain altogether too much; it develops a great predominance of the nervous temperament at the sacrifice of other parts of the body, which by inheritance is increased from generation to generation. The balance of structure and harmony of function in organization is radically changed, and carried to an intense development of nervous tissue, which in its very nature is unfavorable to the procreation of offspring. . . .

"But it is in the accumulated, the intensified effect produced by the

law of inheritance, that the most striking and destructive results are to be witnessed."

My argument from this now almost universally recognized condition is this: during the formative and eruptive periods of the permanent teeth they are under the influence of an independent and peculiar vital (nervous) force; this innervation pushes on their development regardless of the more tardy growth of the osseous system; being implanted in a crowded position, in undeveloped maxillæ, they never have an opportunity to recover from it, and emerge in the same disordered arrangement in which the crowns were formed.

The correlation and the connection would seem to be unmistakable. Under such circumstances it would not be expected that any or all organic changes in the nerve center would manifest the same results in detail; a disturbance of function would produce general results, the details of which might vary in every case.

That such a lesion or innervation could only operate upon the permanent teeth is easily seen, when it is remembered that to produce any marked effect upon the deciduous teeth, we should have to go back to intra-uterine life for the period of its influence, and before the child had an independent and sentient being.

This hypothesis does not find any seeming contradiction in our daily observation, for such a disturbance of nerve function might occur only for a limited period, and no other exhibition or evidence of it ever again appear.

In meditating some time since upon the subject, I came to the conclusion that, if my deductions were correct, I should find proof of it in an examination of individuals of sluggish or feeble intellect, and at that time I wrote this sentence:

"In an examination of idiots, we shall be likely to find capacious jaws and teeth not crowded."

If a precocious or stimulated brain in infancy urges on and crowds the dental organs in advance of the growth of the jaws, then a brain of low calibre, or power, will be likely to have associated with it a retarded dentition, but with abundance of room.

After this conclusion of my own, I came across a paper by Dr. Langdon Down, Physician to the Earlswood Asylum for Idiots, near London, and read before the Odontological Society of Great Britain.

Dr. Down's statements, founded upon his observations of nearly a thousand feeble-minded patients, were so astounding, and so at variance with my theory, that the picture which I had painted seemed to vanish like a vision.

His most startling statement was embodied in these words:

"A marked character of the teeth of idiots is their irregularity as to position. They are often crowded,—so crowded as to present their sides instead of their anterior surfaces.

"They are often arranged on different planes. The canine teeth are frequently unduly prominent, and a marked sulcus is sometimes seen between the incisors and canines, with prominence of the incisors. . . .

"Of the most significant value, however, is the condition of the palate. I have made a very large number of careful measurements of the mouths of the congenitally feeble-minded and of intelligent persons of the same age, with the result of indicating, with some few exceptions, a markedly diminished width between the posterior bicuspids of the two sides." . . .

"One result, or rather one accompaniment, of this narrowing, is the inordinate vaulting of the palate. The palate assumes a roof-like form. The vaulting is not simply apparent from the approximation of the two sides; it is absolute, the line of junction between the palatal bones occupying a higher plane. Often there is an antero-posterior sulcus corresponding to the line of approximation of the two bones." . . .

So constant and universal did Dr. Down state that he found irregularities of the dental organs of one form or another, that he relied upon the evidence of the mouth as a valuable factor in making his diagnosis of the character of the idiocy. This essay, coming from so distinguished an authority, called forth an article "On the V-shaped Contracted Maxilla," from the pen of Mr. Charles Tomes, who undertook to trace these phenomena back to their origin and explain them.

This contracted or V-shaped arch, I gathered from Dr. Down's paper, was the most inimical and the most pronounced of all deformities of the dental organs, and this statement in particular was the most contradictory of my own hypothesis and of my personal observations; for during a period of twenty-five years I had been noting and treating all forms of abnormalities, and the V-shaped or contracted arch was universally associated with a higher order of intelligence. On the very day of this writing, I examined the mouth of a lady in which there was seen contracted and V-shaped arches in both upper and lower jaws of most decided character. The lady was one of unusually well-balanced mind and of a superior order of intelligence. No ordinary observer could possibly associate any feebleness of intellect with the abnormality in the person of this lady.

To gather evidence from a more extended field, and, if possible, to reconcile seeming inconsistencies, I undertook an investigation which has been continued with more or less interruption until the present time.

In entering upon an investigation of this kind, with a view of demonstrating a fact in science, it is of the utmost importance that there be no ambiguity of language or terms.

I have heretofore spoken of the normal type of the dental arch being a regular curved line.

I wish now to state that the absolutely, perfectly regular line is very rarely found in either ancient or modern skulls. To be more explicit, it will be found that nearly every case which would be pronounced regular by an expert on looking at it, will show variations when put to a mathematical test.

For instance, if a piece of soft wire be bent around the outside of the circle so as to touch every tooth, it will show places indicating that certain teeth are either within or without the line, and yet the deviations are so little as to be hardly observable by the ordinary critic.

Such deviations as this I do not class under the head of irregularities, because they are no more out of the limit of normality than are the varieties of feature in different members of the same family.

Furthermore, it is not certain that they are in any sense developmental in their origin, and if not they cannot be used as an argument in an investigation into development.

My own opinion is that, with the exception of inherited deformities, almost all cases of slight peculiarities of position result from the accommodation of articulation with the opposing jaw.

We remember their anomalous position before eruption; if they continued to grow in the same direction, great general disorder would be the result.

That they ever come perfectly into line, is due partly to the enlargement of the jaw encouraging it, and partly from articulation with the antagonizing teeth on occlusion. As it is only *inclined* surfaces that come in contact, we can readily see that a jaw which has the full measure of natural tendency to regularity, may thus show some deviations, as the permanency of the structure is attained.

A peculiar rotary movement in masticating, when teeth are erupting, may be sufficient to throw a bicuspid ever so slightly out of position, which malposition may be considerably increased or it may be corrected, by contact with the opposite tooth on occlusion.

In the investigations I am about to describe, I used pieces of thick card-board cut about two and a half inches square, which were inserted in the mouth, the teeth closed, and with a pencil a line was drawn around the circle and close to the teeth. In such a diagram both the size of the arch and its form can be studied.

My first visit was to the inmates of the Asylum for Idiots upon Randall's Island, numbering about two hundred. The result was as follows:

I did not see a single pronounced case of V-shaped dental arch; I saw but very few cases of narrowed palatine arch; I saw but three or four of saddle-shaped palates, *i.e.* where the sides of the palate approximated in the bicuspid region.

I saw but little irregularity in the positions of the teeth; very few

teeth that were out of line, whatever that line was; what little malposition there was, was generally confined to the six front teeth; of these six, the lateral incisors were more generally at fault, being inverted, everted, or twisted. It was not a common thing to find the canines out of line.

Many of the malposed cases were those where the teeth were still erupting, and did not show such abnormal position that I would have felt justified in interfering if the patient had been brought to me for treatment. There was every reason to hope that, when fully developed, they would appear in good position. There were also many cases of retarded dentition.

There was no more irregularity, decay, loss of teeth, or neglect, than I have seen in the same number of youth picked up from the street.

The prevailing impression was, that I had seen an unusual number of well-developed jaws; they would average larger than the fully-developed jaws of the average of my patients; and that they were above the average for density and probable durability.

The dental arch was generally a broad and regular curve; the variations from this, but within the range of normality, were a smaller circle, anterior to the bicuspid, and straighter lines behind them.

The lower jaw corresponded with the form of the upper in nearly every case, and therefore the articulation was almost always *good*.

There were three or four cases (the ones with saddle-shaped palates) where there was a narrowed or somewhat pinched condition of each side against the first molar, with which the lower jaw did not correspond, and the lower teeth articulated there outside the upper ones. There were no cases (save that of John Rawse) where there was any more deformity of contracted sides than is seen in the cases which I have treated, and which are described and illustrated in *Johnston's Dental Miscellany* for the current year.

Associated with the last-named peculiarity, there were four or five where the superior incisors appeared tipped up, as in the so-called thumb-sucking cases, and which it is quite possible were caused by sucking habits; in some of them a vertical gap, of from one-quarter to three-eighths of an inch, between the incisors of both jaws when the teeth were closed, was observed.

There were several cases where the arch was well curved upon the right side, but the left side showed a variation from that curve and a depression of the line. There were more cases where the arch was depressed on only one side than upon both.

I did not see a single case in which there was any abnormality of size or shape of the jaws before the eruption of the permanent teeth.

I was informed that a very considerable number of these patients are

of Hebrew extraction. The others are made up from nearly all civilized nationalities.

These conclusions differed so much from Dr. Down's observations, that I almost doubted my knowledge of what constituted normality and what constituted depravity.

To familiarize myself further with the subject, I went into a somewhat extended investigation of different classes, conditions, and races. In the youth of our public schools, above twelve years of age, I found ample facilities of one kind, and among the various nationalities and races represented in our metropolis, I carried the investigation further. For example: I hunted up every "*Heathen Chinee*" that I could find in New York (and there is a colony of about three hundred), and took a diagram of his mouth. Recently, while spending a number of weeks in Switzerland, I devoted some time to an investigation of Cretinism, and later I obtained authority from the Public Administration of Paris to visit the asylums and hospitals, and make an examination of idiots.

Assisted by Dr. John W. Crane, who rendered me most valuable aid, I made a personal examination of between three hundred and four hundred idiots, with a result in nowise dissimilar to that narrated somewhat in detail of the asylum on Randall's Island, and therefore unnecessary to recapitulate.

By a comparison of my observations of idiots with that of all ranks and conditions in life, as represented in our public schools, I found that, take the idiots as a class and compare them with the lower orders of society as found in this country, and there were no more irregularities in the one than in the other.

In both cases did I find that amply-developed jaws and teeth were the rule, and narrow, pinched, and V-shaped maxillæ and dental arches were the exception. And this was equally true of the Idiots in France and of the Cretins in Switzerland, among whom I did not see a single case of narrowed arch or high-vaulted palate.

From conversations with those in charge of the education of the idiots, I was able to note the intellectual status of the patient and the corresponding condition of the dental organs. It was thus I discovered, that in those cases where there was a fair physical constitution and development, the intellect in a progressive state, and considerable hopes entertained of mental improvement, the jaws and teeth were in a normal condition. As the scale descended until we arrived at that melancholy condition of absolute idiocy, upon which all improvement was hopeless, I found jaws and teeth, and, in a measure, the whole physical condition, degenerate. Thus did I see the extremes and the gradations, beginning with a sluggish or feeble mind, in a fair organization with well-developed jaws, descending in regular sequences through all the grades of imbecility to unconditional vacuity, asso-

ciated with corresponding disorganization and degeneracy of the teeth, jaws, and whole physical system.

The accompanying cuts represent casts illustrating these extremes in the dental development of idiots. Both these subjects were found in the Asylum on Randall's Island, and both are congenital idiots.

FIG. 2.

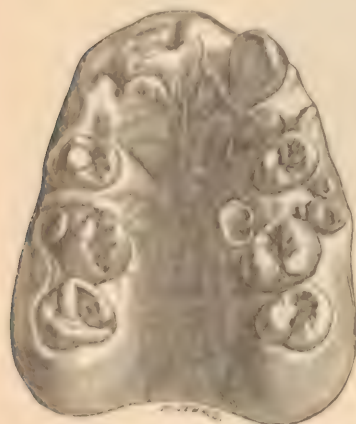


FIG. 3.



Figs. 2 and 3 show the form of jaws and arrangement of teeth in the mouth of John Rawse, an idiot of the lowest type and incapable of improvement. He was born in 1843, weighs now seventy-two pounds, and is four feet seven and a half inches high.

Figs. 4 and 5 represent the jaws of a boy fourteen years of age, of full average height and good physical organization. The record shows him to be "disorderly and wild; incapable of improvement under special training."

This experience had been so uniform on both sides of the Atlantic, that it was with feelings of hesitation as well as of desire that I accepted an invitation from Dr. Down to visit his asylum, near London, and see for myself the evidence upon which his convictions were based.

Together, we made a careful examination of every inmate of the institution, with a result not so widely different as I had supposed must exist.

There were, to be sure, a larger percentage of irregularities of the teeth than I had before observed. About five per cent. might be said to be pronounced cases of narrowed or V-shaped arches, and another five to ten per cent. might be said to have more or less tendency in that direction, but of the more positive cases I did not see one so marked as I have seen and treated in private practice, and associated with full intellectual development.

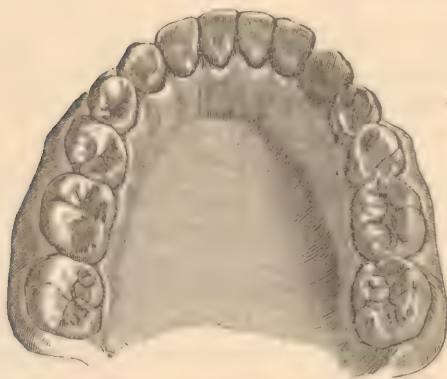
Of the total number, I could not pronounce one-half, or fifty per cent., as showing an irregularity of dental development out of the range of

normality, or that might not have arisen from accidental causes operating on the crowns of the teeth after eruption, and therefore only incidentally connected with idiocy, and in nowise correlated thereto.

FIG. 4.



FIG. 5.



In justice to Dr. Down, I must say that I found in him an enthusiastic co-operator, without any pet hobby to sustain against evidence, and only too glad to obtain aid in his investigation into the symptoms of idiocy from any source.

It was with the hope of obtaining aid that he went before the Odontological Society, with the expectation that the observations of experts in dentistry would throw some light upon the subject.

In this way only is to be accounted for the difference of opinion which existed between us upon many cases which seemed to him an unduly high vault to the palate, narrowed arch, or irregularity, but which, to my eye, came clearly within the limit of normality. Nevertheless, there

was no mistaking the fact that there was a larger percentage of the kind of deformities which he had described, than I had found in any other collection of idiots. This fact was the less contradictory of my former experience, and the less puzzling, when I learned that nearly all the cases which I had seen were the offspring of noble families, or of the higher orders of society, which, in Great Britain, are more strongly marked than in any other portion of the civilized globe.

From one of Dr. Down's conclusions I must still dissent. In his essay, he says, "It was in my inquiry into the condition of the teeth and mouth especially, that I arrived at the conclusion that, in by far the larger number of instances, I was able to indicate the period at which the depressed condition commenced, and to predicate in some degree the amount of improvement which physical, intellectual, and moral training might possibly effect.

"In children where idiocy is accidental, arising from causes operating after uterine life, there is but slight deviation from normal condition in the state of the mouth and teeth, while it is in those whose malady is congenital, especially where arising from causes operating at a very early period of embryonic life, that the deviation of the mouth and its appendages from a normal condition is most pronounced."

I cannot see any connection between these phenomena and causes acting especially "at a very early period of embryonic life;" when we consider that the deciduous teeth are well placed, and that it is only after they pass away that abnormality appears, also that it is only at the very latest period of embryonic life that even the germs of the permanent teeth are found, it is difficult to conceive the connection or correlation.

If the cause antedates the birth of the child, I should seek for its origin, not during the intra uterine life, but as a like deformity existing in the progenitor, and associated with a *tendency* to idiocy,—developing into idiocy in the child, and carrying with it the physical deformity of the parent.

If there was always a disturbed condition of the deciduous teeth, we might pronounce on the congenital origin of the idiocy without hesitation; but when we find the deciduous teeth regular, and the permanent ones only irregular, we cannot find in this, evidence of early embryonic disturbance.

With the panorama before us of the development of both sets, we can only say with confidence that the abnormality of brain did not influence the position of the teeth until about or after the period of birth,—being the period covered by their growth.

Not long since, Mr. C. S. Tomes published an ingenious and somewhat elaborate theory, "On the Developmental Origin of the V-shaped Contracted Maxilla," basing his arguments upon the investigations of Dr. Down.

Instead of accepting his hypothesis as justified by the premises, I am confirmed in the belief that wherever such abnormalities as he describes appear in unmistakable congenital idiots, they will be found peculiarities of transmission by inheritance,—like deformities existing in the ancestry.

Again, Dr. Down says, "An appeal to the condition of the mouth is an important aid in determining whether the lesion on which the mental weakness depends is of intra-uterine or post-uterine origin. In the event of the mouth being abnormal, it indicates a congenital origin: while if the mouth be well formed, and the teeth in a healthy condition, it would lead to the opinion that the calamity had occurred subsequently to embryonic life."

This opinion of Dr. Down is exactly the opposite of my own. There are so many cases where the proof is incontestable that the idiocy is of congenital origin, and where the dental development is perfect, that if I were to draw any proof from the facts, I should say that the regularity of the dental organs showed conclusively that there had been no lesion or disturbance of the brain (in the true sense) after birth, and that the teeth grew regularly in accordance with physical laws under a low order of intellect.

These remarks, of course, do not apply to epileptics, nor to imbeciles who were bright in infancy, and from any cause, afterward, degenerated.

Let it be borne in mind that no irregularity in the position of the dental organs is any evidence of idiocy in the individual. The cases are so common where such deformities are found associated with the highest order of intelligence, that if I were to draw any inference from that condition in the abstract, I should say that it was more likely to indicate a precocity of mental development in the child, and very possibly a more brilliant intellect in the adult. At all events, it does conclusively prove a disturbed cerebral condition at some period in the child's history; or, if it is the result of hereditary taint, shows such a condition in the progenitors, which has originated from like causes, and, unless checked, will become intensified by transmission under similar surrounding conditions; and the future history of that family will be mental degeneracy.

An inherited taint, disturbance, lesion, predisposition, or tendency to idiocy, of which these irregularities are only a symptom or proof, may show itself in a precocious mental development in one instance, and be the precursor of insanity in the same individual, or appear as idiocy in posterity.

A résumé of my experience and observations shows the following results. In private practice I have seen a very large aggregate of dental deformity, and in most instances associated with an intellectual capacity above the average of mankind.

These abnormalities have not been confined to any prevailing type, but have included nearly every possible variety of irregular development. In the public schools, among the middle and lower classes of society, I have found but a small percentage of pronounced irregularity. Such as I have found was in nearly every case among the brightest children of the schools.

Among the children of good physique and fair mental capacity, the development was on the whole regular and normal; a noticeable fact being that the jaws were generally capacious and ample for the regularity of the teeth. In an occasional instance, there might be found a jaw of undue capacity and with separated and straggled teeth. One instance of this kind was particularly marked, and on making inquiry of the principal as to the status of the scholar, I was told that she was the dullest one in the school of over three hundred, and, although of an age to justify an entrance into the highest class, she could not rise above the lowest.

In the examination of idiots I have endeavored to separate those where the mental defect dated from birth, from those who in infancy showed the average mental capacity, and who from accident or disease afterward degenerated into imbeciles.

No more reliance is to be placed upon an examination of the jaws and teeth of the latter class, in a question of development, than upon an examination of the inmates of an insane asylum.

Confining myself to congenital idiocy, I found only a small percentage of pronounced irregularity in form of the jaws or arrangement of the teeth, and that generally associated with the lowest type of idiocy and the kind of which mental improvement was the most hopeless. Associated with deformities of the jaws were usually other abnormalities of physique showing a general constitutional disturbance.

Among the Cretans, capacious jaws were universal. Only among idiots drawn from the higher classes in Great Britain were there found exceptions.

My collection of evidence on this subject closes with another extract from Mr. Mummery's paper: "The Australian races exhibit in the configuration of the skull the lowest type of the human family. The cranium in these people is very narrow, the forehead low and receding, the teeth—especially the canines—project in a striking manner, and other irregularities were frequent.

"The physical character and habits of the Tasmanian race (now nearly extinct) so closely resemble the Australian, that I need only observe that in all points relating to disease, irregularity, etc., the defects of the Australian are exaggerated in the Tasmanian."

The deductions which I make from this array of facts, made up from all ranks and conditions of life, including races, nations, and classes,—

ancient and modern,—from the highest order of intelligence down to the idiotic, are as follows:

A perfect dental development is the result of well-balanced physical and nervous systems, without hereditary taint.

The causes of irregularities I classify as developmental and accidental; the developmental operating prior to the eruption of the teeth, and the accidental subsequently.

Abnormalities of development having their origin in the same individual are due to a disturbance of the trigeminal nerve during the period in which the crowns of the permanent teeth are forming and arranging themselves in the jaw prior to eruption; or, when arising from causes antedating the life of the individual, are traceable to an inherited tendency, which tendency had its origin in a like disturbance in one of the progenitors, and was subsequently transmitted; or are the result of mixing different and distinctly-marked types of jaws and teeth by the progenitors.

In our view we do not call a feeble mind, a sluggish brain, or a dull intellect, a nerve lesion or a brain disturbance. For it is abundantly proven that when this condition is associated with an average physique, the development of the dental organs is tardy, but in regular order.

We have before us, then, both the solution of the problem and the evidence of most alarming symptoms in the physical and mental condition of the inhabitants of the centers of civilization.

There can be no question that the Creator intended there should be perfect harmony in the development of physical and nervous systems, and that where such harmony exists we come nearest to the standard of a perfect organization. This harmony of organization or true balance of the two systems demands that in the earlier years of life the brain and the nervous system be held in abeyance to the physical.

The healthier mental organization is of slower growth. If, therefore, we find that a certain mode of life destroys this harmony, breaks up this balance, there will follow necessarily deterioration and destruction of the race; and this is based on well-recognized physiological law; if the brain and the nervous system are in an undue state of activity, the drain upon the sources of nutrition will be at the expense of the physical system.

No force operating on the brain can interrupt or alter the type, or inherited model of the dental arch, after the first decade of life. All brain disturbances occurring during that period showing mental aberration, we should class under the general head of idiocy—imbecility. After that period, such manifestations come more properly under the head of lunacy,—insanity,—which might degenerate into imbecility or idiocy.

Consequently, neither lunacy nor insanity, in the ordinary acceptance of the terms, can have any direct bearing upon the development

of the dental organs; but such a condition would be most potent of evil if transmitted to offspring.

I do not hesitate to place it upon record that the next generation will see more of abnormality in dental development, and an increase of nervous and cerebral diseases, and that the two are correlated and spring from the same cause.

It is too late to stop it in those who have passed infancy, but it is not too late to modify and partially remedy the evil in those now being born, and those who may be begotten hereafter.

To fathers and mothers surrounded by luxury and flattered with the precocity of their infants, which they are stimulating to the last degree, I say, You are the enemies of your race; you are sowing the seeds of nervous, mental, and physical disorders, from which the harvest will be fearful, and the end death to your family and your name. Do not, under peril, encourage this brilliancy of your child, which is now so charming; let the mind stagnate rather.

For the first seven years of life give concern *only* to his morals and to his physique. Nourish him as you would nourish an animal from which you desired the finest development, stimulating *only* his moral nature, and his intellect will take care of itself. Thus, if he have no hereditary taint, you will have laid the foundation of a splendid specimen of his race.

Discussion.

Dr. J. E. Garretson, of Philadelphia. It would certainly, gentlemen, be doing a very superfluous thing to make any supplementary addenda to this paper of our respected friend. If all of you feel as thankful to him for the information that he has afforded us, and for the patient work he has done, as I do, I think I may say that he should consider himself rewarded, at least in part, for the effort he has made. And yet, strange as it may seem, I have had an experience scarcely in accordance with certain of the conclusions enunciated in his exhaustive paper.

I remember that some time since Dr. Jas. W. White, who, by the way, has made quite an extensive series of observations in a direction similar to those of Dr. Kingsley, queried with me in the beginning of these experiments as to whether the shape of the mouth had anything to do with force in character, and I at once replied that I thought a deep arch indicated lack of mental force. It seems a remarkable thing that it had come in the line of my observation to see many persons of inferior development having these deep and irregular mouths, and so I thought myself not without data in asserting that deep and triangular mouths are associated with inferior mental organizations. With such answer to his query on my part, Dr. White started out on his observations, to come back, however, very shortly, saying to me, "You are entirely mistaken." His observations had agreed with the experi-

ences of the paper which has just been read. This, at any rate, may suggest to us the necessity for caution in stating a proposition in this direction, and the desirability of withholding a positive assertion of opinion until one has reliable data on which to base opinion. Now, I think I am prepared to forego my own observations and give the preference to those of our friend Kingsley, as being more extensive and made after the proper manner. My own were made entirely "*en passant*," not being based on any intention of searching out either a fact or a law. Both Dr. Kingsley and Dr. White have dissected their conclusions, and we seem forced to accept them. But the paper just read contains one paradox, or at least a seeming paradox. So great a one, in fact, that I must infer I have misunderstood the reader, so I will beg to be allowed to ask a single question :

Did I understand the gentleman to say that the premature extraction of deciduous teeth has nothing to do with irregularity in the second set ?

Dr. Kingsley. No ; if you did, it was a mistake. I say the extraction of the deciduous teeth will certainly, under the present condition of society, ultimate, in almost every case, in the canines being thrown out of line.

Dr. Garretson. I thought I must necessarily have misunderstood the gentleman ; there seemed in his premise, as I understood it, such a lack of congruity with the general character of his paper.

Dr. Kingsley has referred to the double teeth of Tom Thumb as indicative of the fact that an interference with physiological progression is the cause of irregularity. I remember that some time since one of the gentlemen connected with a dental college made a remark of this kind : " Certain people," he said, " who speak without thinking, have unwisely asserted that irregularity is markedly associated with hereditary transmission."

Now, this struck me as a very strange remark ; and its author, I thought, might just at that moment have off his own thinking-cap, because all observations go to show that irregularities seen in one generation will be very apt to be found transmitted to that succeeding.

I am not entirely prepared to agree with Dr. Kingsley, that the nervous irregularity to which he refers has so much to do with irregular development of the teeth, and for the reason that I find everything guided and influenced by a principle. Certainly all matters which pertain to the development of a human being are so guided and influenced, and if nervous irregularity is the cause of irregular dental development, I cannot but ask myself why there should not be errors as well in the development of the cheek, or why one nostril should not be out of line, etc. But I can agree with Dr. Kingsley in the inference he would

naturally make, that nervous disturbance—the prostration of nervous force—has immensely to do with that quality of the teeth, and with that tooth substance with which, in an after period, our profession so intimately brings us in contact. As it has been happily said, “We are only in the infancy of our profession,” and this I for one recognize so well, that I fear I have not the patience I should have when I hear gentlemen enlarging too exhaustively upon dental mechanism as constituting the *summum bonum* of the specialty. Here is a great matter to which the paper may well serve to call our attention,—appreciation of that which constitutes the science of the specialty.

I cannot but think our time would be better employed, generally, if spent more in studying causes. I take my seat, repeating my thanks to the essayist for the double character of lesson afforded by his most excellent paper.

Dr W. H. Atkinson. The time given is hardly sufficient to awaken an interest in the vast subject that has been broached before us. Before I proceed to a discussion of the subject itself, I want first to compliment this body upon having a member able to present us with such a production, and secondly, to make my own personal acknowledgment for the benefit that I have derived, and for the light that has been thrown upon the details of a subject that has interested me all my professional career.

Now for criticism: the title of the paper is “Causes of Irregularity.” There is the rock of offense, there is the bone of contention, whether it be cause or causes that we are dealing with, and whether cause can be anything but absolute and infinite, and whether causes are not always simply sequences or successive presentments of the activity of that one infinite cause that lies behind the whole. When you have a plurality of causes, you have not reached the primary: so you see, that, according to the scope of the paper, we have the whole law of evolution—the whole law of development—brought before us, involving all the differential order of scientific presentment in organic relation. Now, who shall lay down the alphabet of first principles in this matter, to enable us to travel with some degree of certitude (or else not travel at all), until we shall have laid the corner-stone and foundation of what evolution is? In the first place, if we say *evolution*, we have invoked *involution* prior to that.

He struck the key-note when he gave neural influence as the origin of all function in mammalia. But the origins to which he traces certain effects are origins only in a very modified sense. It may have been the origin in the particular case he had in mind, but not the typical and absolute origin. In the study and investigation of morphology and embryology, what do we see to start with? A simple folded tract in the little bleb of super-oxydized hydrate of carbon, which begins by

enfoldings and reduplications of enfoldings, and we find that this little groove, or tract, or canal, is the basis from which all the rest sets out; in other words, a focus of type possibilities of individual existence. What more have we? Namely, this, that if this is placed under enabling circumstances, supplied with the vivifying sperm, its development may be carried forward to the perfection of typical organization. Have we any such personal perfection? No, sir, and there has been only one case on the face of the earth that was developed according to the possibilities of the type which was coiled up in that bleb of oxyhydrate of carbon. But by that very example we see there is a type by which we may get perfection of development if coincided with.

In the schools for idiots and imbeciles we have learned that even the poorest are capable of being improved to a certain extent. And how is it done? By supplying the pabulum,—the enabling circumstances,—so that this type can express itself; and then we get not only the physical presentment, but the mental endowment. There is where the paper follows too much the “old foggy” method,—dividing the physical and mental as being separate and distinct. Even in a rock there is intelligence; even a crystal knows when the law of its typical proportions are fulfilled, and you have in silex the typical six-sided crystal. We have not understood what was involved,—that it was endowment of power in elementary substance. We have not understood the proper and normal primary relations of things. When the cerebral vesicle divides into its normal type of fissures and clefts, we then have the neural sheet, the vascular sheet, and the muscular sheet; and in this neural sheet the teeth have their origin.

The teeth are dermal structures. They are epidermic, endermic, and hypodermic. In the pulp there are produced vessels and nerves by a successive supply of the elementary bodies, which are blood-corpuscles, which constitute the soft-solids of the tissues. When any irregularity of arrangement of these elements takes place, it is because we have interfered with the alternation of generation in the cells of these tissues. There it is that we shall find the cause, or rather the expression of the cause, of disturbance in the formative process.

I have repeatedly been blessed with complete reproduction of nerve-tissue, but have never seen reproduction in muscular tissue. A development of a higher expression of mental power is not affected by a waste of animal development. There is no such thing as a superfluous development of something that is heterogeneous. You might just as well say that pathology is death. It is not death, but a measure of physiological activity less than the full requirement of the type.

In the artificial incubation of the chicken, by breaking the eggs at various stages and under various conditions, we are able to see that there is one expression that is capable of being interfered with. Development

will not go on below ninety-five degrees Fahrenheit, or above one hundred and five degrees. You must keep within these ten degrees of the thermal scale in order to secure incubation. Beyond that you never can get a proper form of tissue.

Now, the causes that we discern here as influencing development may be the immediate,—I will not say cause,—the immediate condition of the interference with development; and it is in these interferences with the condition of development that we get into difficulty. If you would do anything in the way of reproduction of tissue, you must remember that all tissues are reproduced on the same plan that they were originally produced.

Dr. J. H. McQuillen, of Philadelphia. I wish to express the pleasure I have derived in listening to the admirable paper just read to us; it is very rare for a communication of such length and of such detail to command the attention which it received and is justly entitled to.

I shall not undertake to pass in review and discuss the various points presented, but will confine my attention to the consideration and applications of an opinion expressed by me some time ago, which Prof. Kingsley has regarded of sufficient importance to quote in his essay; viz., "That when looking at an anatomical preparation of the jaws of a young person" (such as that being passed around the room), "and observing the crowded condition and irregular positions of the crowns of the permanent teeth in the jaws, with the deciduous teeth still *in situ*, it is not a matter of surprise that there should be occasionally irregularity of the permanent set, but rather of astonishment that they should ever come in regular."

Conclusive evidence is thus presented of the necessity of a decided increase in the size of the jaws to afford sufficient room for the permanent teeth upon erupting to form a perfect and symmetrical arch. There is and always has been an opinion prevalent on the part of the profession that the premature extraction of the deciduous teeth induces *contraction* of the jaws and causes irregularity of the permanent teeth. Mr. Charles S. Tomes, of London, in an address before the alumni of the Philadelphia Dental College, February, 1873, opposed this opinion, and cited a case that came under the care of his father, John Tomes, F.R.S., in which all the deciduous teeth were prematurely extracted from a child, yet the permanent teeth came in perfectly regular.

My esteemed friend, Dr. Isaiah Forbes, of St. Louis, previously to this had directed attention to the fact that the premature extraction of the deciduous teeth does not produce contraction of the jaws, in the *Missouri Dental Journal*, and an acknowledgment of this fact was made by Mr. Tomes in his address.

Years ago, in lectures to my students, and in the *Dental Cosmos*, I took exceptions to the prevalent opinion, and directed attention to the

fact that the premature extraction of the deciduous teeth does not necessarily induce contraction of the jaws, but that the *loss of these teeth was calculated to prevent the full development of the jaws; as the growth of a part is dependent upon its use.* The large development of the biceps of a blacksmith and of the gastrocnemius of the ballet-dancer is due to the constant use that they are subjected to. That which is true of muscle is equally true of bone, and the bones of those who labor, as a rule, are larger, more compact, and better developed than those of persons relieved from daily toil. As evidence of the wasting of tissues from want of use, it is only necessary to direct attention to the self-inflicted penance of the Fakirs in India, who, with an arm uplifted to heaven, and maintained in that position for years, have, as a consequence, in a short time, a wasted and shriveled condition not only of the muscles and other soft tissues, but even of the bones of the arm. It necessarily follows that the premature extraction of the deciduous teeth must interfere with the proper *use of the jaw*, and, as a consequence of want of use, insufficient increase of size takes place, and along with this comes irregularity of the permanent teeth.

Irregularity of the teeth in our country no doubt also results from the peculiar and mixed character of the origin of our people as a nation. Races from all sections of the earth come here to find a home, and intermarry with each other. Some of these, as the hardy people of England, Scotland, Ireland, and Germany, simple in their habits of life, and accustomed to coarse, hard food, have large jaws and large teeth; others, as the Italian races, generally with more luxurious habits and accustomed to softer food, have as a rule smaller jaws and teeth. Intermarriages, occurring under such circumstances with the representatives of these opposite nationalities, give us peculiar forms of irregularity:—small jaws, with large teeth in the most crowded and irregular condition, or large jaws with small teeth at a considerable distance apart. In addition to that source of irregularity, we have another prolific one in the fact that our children are indulged in improper habits of diet. Little or no restriction is placed upon their wishes in this respect; they are not compelled, as they should be, to feed upon the coarse food which forms a principal part of the diet of the children even among the higher classes in England, Scotland, and Germany. The necessity of feeding children upon oat-meal porridge, wheaten grits, hominy, and other cereals containing the bone- and tooth-forming constituents, cannot be too strongly impressed upon the minds of parents. In respect to the influence of the trigeminus in the development of irregularity of the teeth, there may be something in it,—to what extent I am not prepared to say. As we have found the use of a part has much to do with its growth, so the nutrition of a part is mainly dependent upon its nervous connections; and there is nothing more evident, so far as experiment is

concerned, than the influence the trigeminus has on nutrition. Experiment upon experiment has demonstrated beyond a possibility of doubt that when section is made of the ophthalmic branch of the fifth pair of nerves, the nutrition of the eye becomes quickly affected, and we have in a short time irritation, inflammation, and a subsequent softening of the parts and loss of sight; and it is reasonable to infer that any impairment of the branches passing to the jaws may exert a deleterious effect upon the growth of the jaw and thus tend to the development of irregularity of the teeth.

Dr. John B. Rich. The paper just read by Dr. Kingsley goes far beyond the scope of my research in this particular direction, and, as the cause of the irregularities of the teeth has always been an interesting study to me, I most heartily thank him for the valuable information and suggestions his paper have presented to my mind. He tells us that the proper way to remedy the irregularities of the teeth is to attend to the physical education of children. From the manner in which this point is stated, I am led to think he is not aware that defective physical culture has been the primary cause of the phenomena he has met with in his investigations of this important subject.

I am an enthusiast on the subject of physical education. In the early part of my life, when a student in Paris, I devoted daily a large amount of time to its culture, and gave considerable thought and labor to the production of a system by which it could be properly taught.

On my return to this, my native city, the evident lack of physical development in a majority of my fellow townsmen who came under my observation, became a source of painful contemplation to me, and the little attention that was paid to a matter of such vital importance surprised me.

Whenever I met any of these half-developed people I felt a desire to do something, if it were ever so little, towards remedying this mal-condition. As years passed by, and my observations were more extended, the evil effects of this peculiarity became more apparent, and the desire to do something in this direction grew stronger and stronger with me. Eventually I established an institution in this city exclusively devoted to systematic physical training and to teaching the general laws of health, and I maintained it in operation for several years.

Among the large number of persons of both sexes and of all ages who attended this training school, I had ample opportunity to investigate the subject of imperfect development. I propose to make some remarks upon the relation of physical culture with the subject of Dr. Kingsley's paper.

From extended observations, made under favorable circumstances, I have come to the conclusion that at the period of early childhood no one part can be well developed where there is not a fair development

of all the other parts of the system. As few of those mothers who live in large cities take sufficient general exercise during pregnancy and the period of nursing to produce a vigorous condition of health, those parts of their offspring that are formed under such conditions cannot be of good quality. Therefore the primary cause of the defective structure of the teeth and the irregularity of their arrangement is the result of the bad condition of the physical powers of the mother at the time of her pregnancy with and lactation of the subject of these defects, producing an imperfect physical condition of the offspring while the teeth are being formed. Although the defective quality of the teeth and the evils which follow such construction cannot be entirely overcome, happily for the child, the delicacy of the rest of its system and the tendency to irregularity of the teeth can be changed by proper regimen and thorough physical culture persistently applied from early childhood to full maturity.

Were such means always employed under such circumstances I do not believe we would ever see imperfect arrangement of the teeth; and I have often thought what a vast amount of good to our race could be brought about if every dentist would become a missionary in the cause of physical education.

It is his legitimate province to impress upon those who come within the scope of his influence the great importance of physical culture and a proper regimen, to produce robust health in those who are likely to become mothers, for he, above all others, has constantly before him the evils resulting from a low condition of health under such circumstances. Let him also, whenever he has an opportunity, endeavor to impress upon the minds of those who have transmitted delicate teeth to their children, the urgent necessity of eradicating, as far as possible, those deleterious properties, by building up the systems of those young lives so afflicted.

One of the errors that our population suffers from, because it leads to the certain deterioration of our race, is the general desire of American parents to foster in their children a precocious mental development, oftentimes to the entire neglect and consequent destruction of their physical systems. Here the dentist, when called upon to examine the teeth of such children, has the opportunity to give his advice and say to the fond mother who is so proud of her bright but delicate child, "Madam, repress that undue mental growth, and exert all the means in your power to give this dear child a robust constitution and good physical development. Its teeth teach me that is now its greatest want; give it plenty of bodily exercise in the open air, and let its mind alone." And this reminds me that one of the experiences of my physical school bears directly upon this point, which was this: that when I attempted to build up delicate systems, no progress towards a satisfactory

result could be made until all serious mental occupation or culture was abandoned; this was the case with adults as well as with children, and in many cases it became a matter of paramount importance that the mind should cease all labor and be turned into recreative channels.

I spent a portion of my life in parts of Asia, Africa, and among those nations who live on the borders of and the regions around the great desert of Sahara. Some of these nations are only semi-civilized, and many of these people spend the greater part of their lives in the open air, and from their simple diet, and the large amount of bodily exercise they take, splendid physical development is almost universal, and cases of defective structure or arrangement of the teeth are scarcely known among them.

To exemplify what may be accomplished by careful systematic training, I will mention one of the performances of a class I had in training in the institution I have spoken of. This class was composed of ladies of all ages, and they met for instruction and practice three times a week; most of them belonged to the wealthy portion of society, and a majority of them were confirmed invalids when they joined the school.

When they had been in training about eight months, I wished to test the progress they had made, and without telling them that what they did that day was to be considered as a test of their improvement, I commenced the experiment of their endurance. I had constructed around the verge of the main room, a pedestrian track five feet wide, and the twenty fourth of a mile in circumference. On this occasion all the members of the class who were present (and there were but few absent) ran in regular cadence step five miles in forty minutes. Not one of them left the track while this was being done, nor were they the least blown or fatigued at the end of the task. So easily was this done that they did not realize that there was anything extraordinary about the performance. But there was something extraordinary about it, and when I told them that they were the only women in this city who could run that distance in the time mentioned, they were very proud of their performance. Now, when it is considered that these women were from those classes of society where the general habits of the women are such as would tend to render women unfit for any extraordinary physical feat, this performance illustrates what may be accomplished by properly applied systematic training, even with those who at the commencement are in a delicate condition of health.

And I am of the opinion that the only way to successfully cope with those great and growing evils, imperfectly constructed and irregularly arranged teeth, is by directing attention to the necessity of improving the physical condition of those women who are to be the mothers of the generation still to be born.

Dr. T. C. Stollwagen, of Philadelphia. Through the kindness and

courtesy of Dr. Bogue I was informed of the subject to be discussed at this meeting. Living in the neighborhood of a very large training-school, the Pennsylvania, and being personally acquainted with its superintendent, Dr. Kerlin, it seemed well to embrace the opportunity to examine the mouths of the inmates of this institution, without any theory either to make or unmake. I am very happy to say that what little I saw and what little experience I had there precisely confirms the views of Dr. Kingsley, which we have had given to us this afternoon. In the course of my examinations (which were rather hastily made, from the fact that I first wished to take a general view of the inmates and afterwards particularize), I found that in all I examined the mouths of ninety-seven males and eighty-seven females, making in all one hundred and eighty-four patients. Among these there was a very small percentage that, had they been presented to me in my office, would have warranted interference, in any manner, as regards the regularity of the teeth.

I then re-read the paper of Dr. Langdon Down and the subsequent paper of Dr. James W. White, and found my examinations, though hasty, fully confirmed Dr. White's, which were made more carefully and with measurements.

The teeth of the inmates of this institution were generally unusually fine, if we make certain exceptions,—first, we must expect, inasmuch as many of them were so imbecile in mind as to be incapable of even feeding themselves, to find neglect and uncleanness; secondly, there was an unusual number of incisor teeth absent from the mouths of those that had advanced to the age of fifteen or over. I was first conducted into the nursery, where the most hopeless cases of idiocy are kept, and in the very first examination found that the lateral incisors were wanting, and that the canines particularly looked unusually sharp and somewhat stunted in growth. The question at once forced itself upon my mind, possibly here was a peculiarity that had not been reported? but, on a more thorough examination of a greater number of cases, this did not hold true. There was nothing remarkable as regards irregularity. The jaws were unusually large, as compared with the same number of jaws in the mouths of intelligent children—such as would seek the services of the dentist,—and the loss of the incisor teeth was readily accounted for by the fact that in their paroxysms of rage, and even, as it seemed, at times, from a sort of delight in inflicting pain on themselves, they had broken out many of these organs. I considered their mouths remarkably well developed. As Dr. Kingsley has already remarked, the predominance of the animal over the mental was probably assisted by a good masticatory apparatus; so that they could properly prepare their food and be benefited by it.

Dr. C. N. Peirce, of Philadelphia. I have listened with extreme

pleasure to the reading of Dr. Kingsley's paper, and more particularly have I been interested because its subject is one to which I have given some little attention. First, in reference to irregularity occurring from premature extraction of the deciduous teeth and abnormal development of the posterior part of the jaw. While I understood the author to recognize fully the unfortunate results from the premature extraction of the deciduous canines, I did not think he gave due weight to the consequences arising from such loss of the second deciduous molar. The first permanent, or what is termed the sixth-year molar, erupting so much in advance of the second bicuspid,—which is the successor of the deciduous molar,—the latter, if prematurely extracted, has the space invariably occupied by the permanent molar, thereby throwing the bicuspid either upon the lingual or buccal side of the alveolar ridge. Again, in the development of the jaw, growing as it does by adhesions to the posterior part of the ramus of the jaw and absorption of the anterior part, we may have, by a suspension of this latter normal condition, a deficiency of room, and as a result that distressing and embarrassing condition, the displacement or non-eruption of the second and third molars. This manner of the growth of the jaw I had fully demonstrated to me a little more than a year ago, when I had the pleasure of visiting Dr. Tomes, of London, and accompanying him to his lecture-room and museum. He showed me two jaws, one with the ramus almost completely removed, leaving but a line of the posterior edge and a trace of the condyle. Here was absorption progressing normally without a corresponding development or growth at the posterior edge. In the other was the reverse condition,—development had progressed normally, while absorption had been arrested; as a result, the ramus was double its natural width, and in consequence thereof, there was an absence of space for the regular development of the permanent molars. Now, a few words in confirmation of the views expressed in the paper upon the correspondence between the development of the jaws and teeth and mental capacity.

While traveling through the Tyrol, of Southern Austria, and Lombardy, in Italy, I had, as had the author of the paper, the opportunity of seeing a large number of Cretins,—disgusting, jabbering idiots as they were, unable to articulate a word distinctly. By the aid of a few small coins I obtained a hasty glance at the oral cavity; which, though not critical or satisfactory, was sufficient to satisfy me of an unusually large development of both superior and inferior maxillæ, with an abundance of room for the teeth. Opportunities have also not unfrequently offered for viewing the mouths of negroes, where mental growth was far below the average, with a decidedly retreating forehead; in such, the jaws were invariably large, the teeth far from crowded, and quite projecting. In my regular practice, cases have not unfrequently

occurred where one or two in a family would have what might be termed *straggling* teeth, or teeth standing alone with an unusually wide space between them; while with other members the reverse condition would predominate. In the former the mental condition was always far below the latter, being a marked reversion to a lower order of development. Mr. Darwin, in his work on the "Descent of Man," speaks of the long and prominent canine "as a case of reversion to an ape-like progenitor;" and remarks, "that he who rejects with scorn the belief that the shape of his own canines, and their occasional great development, are due to our early progenitors having been provided with these formidable weapons, will probably reveal by sneering the line of his own descent; for, though he no longer intends nor has the power to use these teeth as weapons, he will unconsciously retract his snarling muscles, so as to expose them ready for action, like a dog prepared to fight." Those who have studied the normal condition of the teeth recognize the fact that they are of one height, or represent an even line on their masticating and cutting surfaces; so that placing a jaw with teeth so developed upon a plane, each tooth rests with equal force upon said plane. Now, occasionally we find, as Darwin describes, not only a projecting, but an elongated canine; wherever I have found this, the other teeth have had spaces between them, with other marks corresponding to a lower order of development, and confirming the views advanced in the paper under discussion.

It was my privilege some years ago to make monthly professional visits to an asylum, many of the inmates of which were epileptic; with these I had principally to do, and I now distinctly recall the crowded and irregular condition of the teeth, which frequently embarrassed, and at times almost baffled, my efforts. These were patients with no congenital mental deficiency, but quite the reverse,—large and well-developed heads, with a predisposition to nervous disturbance, was the rule, and not the exception, with several families, branches of which were under my care both in and out of the asylum.

With these hasty confirmations of the ideas advanced in the paper just read, which has given us so much information and pleasure, I must pronounce it one of the finest contributions to dental literature I have ever heard read.

Dr. W. H. Dwinelle. As has been suggested by Dr. Atkinson, Dr. Kingsley has struck the key-note to a new, comprehensive, and grand idea. I for one congratulate myself that I am an American, that Dr. Kingsley is an American, and that it has been reserved for this side of the Atlantic to strike at the *root* of this matter, and demonstrate and establish it. We are talking about teeth, and the term *root* is not altogether inappropriate.

I have endeavored, through the teachings of my own experience and

observation, to form a theory of hereditary transmission, which would account for general irregularity of the teeth, and which I may refer to hereafter, but I am satisfied that in most cases my data were gathered from incidental or exceptional cases, and that the general rule must be the one which Dr. Kingsley has so ably exemplified here to-day; certainly he has in a large degree brought order out of my chaos. I think if the matter under discussion were to be expressed in a single phrase, it would be "inharmoniousness of development."

We have certain organs with certain functions, other organs with other functions, and when they are working together, and yet inharmoniously, we have incompleteness, discordance, and irregularity. One of the chief functions of the trigeminal nerves is to develop the teeth, while the function of the osseous structure is to produce the basis upon which the trigemini shall place and arrange the fruits of its labor. One produces results of a comparative standard character, while the product of the other is variable and fluctuating. There is inharmoniousness and want of concert of action in cases of irregularity between the foundation and the superstructure; the superstructure is too large for the foundation: the superstructure is standard and normal, the foundation is small and abnormal.

Should we ever adopt a mythology of our own, the god Trigemini would be the divinity whom we would propitiate, for he presides over the organs which make our profession possible, and is the good genius who has developed our calling into a science and an art, and under whose smiles of welcome and whose approving and protecting wing we have gathered here to-day.

I invariably associate irregularity of the teeth with high living, high intelligence, and an excess of the mental and nervous over the physical. Where the physical has been fully developed, the teeth, as a rule, fall into their regular line in the arch.

Allusion has been made to the case of Tom Thumb. Here is a striking instance where a contracted arch has resulted in irregularity of the teeth,—the teeth, being fully and normally developed, of necessity could not come in, except in a double line.

In the case of the giant,—except with those who belong to a race of giants,—where the foundation is large and abnormal, the teeth being of normal size, of necessity cannot fill the arch, and large intervals are left between them. Precocious tendencies in the individual are apt to find expression in the development of the teeth.

The general cause of irregularity of the teeth, as has been indicated, arises from the development of the nervous and brainial at the expense of the physical, inducing also in its train of evils paralysis, apoplexy, softening of the brain, and brain affections generally. In an article on "Brain Difficulty," published in one of the foreign quarterlies a few

years ago, it was demonstrated that there were more affections of the brain and nervous system in the city of New York, in proportion to the number of its inhabitants, than in any other city in the world. We stimulate our energies too far, we overtax our brains and give ourselves little or no recreation, we carry our business home with us, and merge the perplexities of our worrying cares into nightmare dreams. Death comes to us suddenly, unnaturally, and before our time, and our posterity is cursed with a sad inheritance, the sure penalty of outraged physical laws.

The remedy for irregularities of the teeth in the future must be associated with such measures as have been recommended here to-day; the mechanical correction of such deformities, so as to arrest so far as possible their tendencies, and then to cultivate all influences which shall re-establish the harmony between the nervous and physical system.

From Dr. Kingsley's paper I make the following digest or series of deductions. That irregularity of the teeth arises from three causes:

First. During the life of the individual, owing to a cerebral disturbance while the teeth were forming.

Second. If antedating that individual life, it arose from like causes, transmitted.

Third. Arising from mixing inharmonious types, large teeth with little jaws.

The teeth of idiots may be divided into two classes:

First. Where there is a fair physical organization, with very low but progressive order of intellect, the teeth and jaws are normal.

Second. Absolute idiocy, associated with general physical disorganization,—teeth and jaws included,—the whole system wrecked, belong to no order, and are mere *lusus naturæ*.

